CLAIMS

1. A method for extracting data of interest from observed vector data, the method comprising:

determining the projection of each vector in observed vector data onto a subspace as a vector subtraction in an original coordinate system.

2. A method for processing a block of discrete data vectors to obtain a decomposition of the data with respect to a correlation direction vector, the method comprising:

multiplying each data vector onto the correlation direction vector to determine a scalar amplitude of each data vector in the direction of the correlation direction vector;

multiplying each scalar amplitude onto the correlation direction vector to determine a set of scaled vectors; and

subtracting the scaled vectors from the data vectors.

3. In a filter, a method for processing a block of discrete data vectors to obtain a decomposition of the data with respect to a correlation direction vector, the method comprising:

multiplying each data vector onto the correlation direction vector to determine a scalar amplitude of each data vector in the direction of the correlation direction vector;

multiplying each scalar amplitude onto the correlation direction vector to determine a set of scaled vectors; and

subtracting the scaled vectors from the data vectors.

4. A method for adaptively analyzing data, the data characterized by a set of data vectors, to estimate that part of the data that best corresponds to a steering vector, the method comprising:

in a first analysis stage:

projecting each data vector onto the steering vector to form a set of inner products that estimate the part of the data that best corresponds to the steering vector,

multiplying the inner products onto the steering vector to form a set of vector estimates of that part of the data that best corresponds to the steering vector,

subtracting the vector estimates from the corresponding data vectors to obtain a projection of the data onto the nullspace of the steering vector; and

in at least one adaptive analysis stage:

calculating a correlation direction vector of the current adaptive stage between the corresponding inner products and vector differences of an immediately prior analysis stage;

forming inner products of the current stage by projecting each vector difference of the immediately prior analysis stage onto the correlation direction vector of the current stage;

forming scaled vectors of the current stage by multiplying the inner products of the current stage onto the correlation direction vector of the current stage;

forming the projection of the prior stage vector differences onto the nullspace of the correlation direction vector of the current stage by subtracting each scaled vector of the current stage from the corresponding projection of the prior stage.

5. A method for adaptively analyzing an observed signal, the signal characterized by a set of data vectors, to estimate that part of the signal that best corresponds to a steering vector, the method comprising:

in a first analysis stage:

projecting each data vector onto the steering vector to form a set of inner products that estimate the part of the data that best corresponds to the steering vector,

multiplying the inner products onto the steering vector to form a set of vector estimates of that part of the data that best corresponds to the steering vector,

subtracting the vector estimates from the corresponding data vectors to obtain a projection of the data onto the nullspace of the steering vector; and

in at least one adaptive analysis stage:

calculating a correlation direction vector of the current adaptive stage between the corresponding inner products and vector differences of an immediately prior analysis stage;

forming inner products of the current stage by projecting each vector difference of the immediately prior analysis stage onto the correlation direction vector of the current stage;

forming scaled vectors of the current stage by multiplying the inner products of the current stage onto the correlation direction vector of the current stage;

forming the projection of the prior stage vector differences onto the nullspace of the correlation direction vector of the current stage by subtracting each scaled vector of the current stage from the corresponding projection of the prior stage.

6. A method for adaptively analyzing discrete data, the data characterized by a vector data set and a scalar data set, the sets having a common index, to obtain a decomposition of the data based on correlation between the sets, the method comprising

in a first stage:

forming a first stage correlation direction vector between corresponding elements of the vector data set and the scalar data set;

forming a set of first stage inner products between the vector data set and the first stage correlation direction vector;

forming a set of first stage scaled direction vectors between the scalar data set and the first stage correlation direction vector;

forming a set of first stage vector differences between the corresponding elements of the set of first stage scaled direction vectors and the vector data set; and

in each of zero or more subsequent stages:

receiving the set of inner products and the set of vector differences of the immediately prior stage as inputs to the current stage;

forming a current stage correlation direction vector between corresponding elements of the sets of inner product and vector difference current stage inputs;

forming a set of current stage inner products between the set of current stage vector difference inputs and the current stage correlation direction vector;

forming a set of current stage scaled direction vectors between the set of inner product current stage inputs and the current stage correlation direction vector;

forming a set of current stage vector differences between the corresponding elements of the set of current stage scaled direction vectors and the set of current stage vector difference inputs.

7. An analysis chain for a multistage adaptive filter, the analysis chain comprising:

a non-adaptive analysis stage, comprising:

a first inner product logic device operative:

to receive a set of data vectors and a steering vector, and

to form a first set of inner products of the steering vector and each data vector, and

a first vector scaling logic device:

in communication with the first inner product logic device, and

operative:

to receive the steering vector and the first set of inner products, and

to form a first set of scaled direction vectors of the steering vector and each inner product of the first set of inner products, and

a first vector difference logic device:

in communication with the first vector scaling logic device, and

operative:

to receive the set of data vectors and the first set of scaled vectors, and

to form a first set of vector differences between corresponding elements of the set of data vectors and the first set of scaled vectors; and

at least one adaptive analysis stage comprising:

a correlation direction vector logic device:

in communication with the immediately prior stage, and

operative:

to receive a set of vector differences of the immediately prior stage and a set of inner products of the immediately prior stage, and

to form a current stage correlation direction vector between the vector differences of the immediately prior stage and the corresponding inner products of the immediately prior stage; and

an adaptive stage inner product logic device:

in communication with the immediately prior stage and the adaptive stage correlation direction vector logic device of the current stage, and

operative:

to receive the set of vector differences of the immediately prior stage and the current stage correlation direction vector, and

to form a current stage set of inner products of each vector difference of the immediately prior stage and the current stage correlation direction vector; and

an adaptive stage vector scaling logic device:

in communication with the correlation direction vector logic device of the current stage and the inner product device of the current stage, and

operative:

to receive the set of inner products of the current stage and the correlation direction vector of the current stage, and

to form a current stage set of scaled direction vectors of each inner product of the set of inner products of the current stage and the correlation direction vector of the current stage; and

an adaptive stage vector difference logic device:

in communication with the vector difference logic device of the immediately prior stage and the vector scaling logic device of the current stage, and

operative:

to receive the set of vector differences of the immediately prior stage and the set of scaled vectors of the current stage, and

to form a current stage set of vector differences between corresponding elements of the set of vector differences of the immediately prior stage and the set of scaled direction vectors of the current stage.

8. A method for adaptively analyzing an observed signal, the signal characterized by discrete data, the data characterized by a vector data set and a scalar data set, the sets having a common index, to obtain a decomposition of the data based on correlation between the sets, the method comprising

in a first stage:

forming a first stage correlation direction vector between corresponding elements of the vector data set and the scalar data set;

forming a set of first stage inner products between the vector data set and the first stage correlation direction vector;

forming a set of first stage scaled direction vectors between the scalar data set and the first stage correlation direction vector;

forming a set of first stage vector differences between the corresponding elements of the set of first stage scaled direction vectors and the vector data set; and

in each of zero or more subsequent stages:

receiving the set of inner products and the set of vector differences of the immediately prior stage as inputs to the current stage;

forming a current stage correlation direction vector between corresponding elements of the sets of inner product and vector difference current stage inputs;

forming a set of current stage inner products between the set of current stage vector difference inputs and the current stage correlation direction vector;

forming a set of current stage scaled direction vectors between the set of inner product current stage inputs and the current stage correlation direction vector;

forming a set of current stage vector differences between the corresponding elements of the set of current stage scaled direction vectors and the set of current stage vector difference inputs.

9. An adaptive stage of an analysis chain for a multistage adaptive filter, the adaptive stage comprising:

a correlation direction vector logic device:

in communication with the immediately prior stage, and

operative:

to receive a set of vector differences of the immediately prior stage and a set of inner products of the immediately prior stage, and

to form a current stage correlation direction vector between the vector differences of the immediately prior stage and the corresponding inner products of the immediately prior stage; and

an adaptive stage inner product logic device:

in communication with the immediately prior stage and the adaptive stage correlation direction vector logic device of the current stage, and

operative:

to receive the set of vector differences of the immediately prior stage and the current stage correlation direction vector, and

to form a current stage set of inner products of each vector difference of the immediately prior stage and the current stage correlation direction vector; and

an adaptive stage vector scaling logic device:

in communication with the correlation direction vector logic device of the current stage and the inner product device of the current stage, and

operative:

to receive the set of inner products of the current stage and the correlation direction vector of the current stage, and

to form a current stage set of scaled direction vectors of each inner product of the set of inner products of the current stage and the correlation direction vector of the current stage; and

an adaptive stage vector difference logic device:

in communication with the vector difference logic device of the immediately prior stage and the vector scaling logic device of the current stage, and

operative:

to receive the set of vector differences of the immediately prior stage and the set of scaled vectors of the current stage, and

to form a current stage set of vector differences between corresponding elements of the set of vector differences of the immediately prior stage and the set of scaled direction vectors of the current stage.

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